PATENT ABSTRACTS OF JAPAN

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(54) MULTIWINDOW DISPLAY DEVICE

(57)Abstract:
PURPOSE: To eliminate a flicker when a window display is updated by shortening a window display update time.
CONSTITUTION: When a request to display a window is made by an application, etc., a window control part 4 registers definition information on the window in a window definition information management part, etc., and secures a window work buffer for storing the display data of the whole window in a non-display area 8 in a video window 6. Then characters, figures, etc., to be displayed in the window are drawn on the secured window work buffer. The display data drawn on the window work buffer are transferred as data in a rectangle to a display area 7 in the video memory 6 on the basis of the window definition information, etc., and displayed on the screen of a display part 10.

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CLAIMS

[Claim(s)]

[Claim 1] An indicative-data storing means with two fields of the non-display field which stores the indicative data which is not displayed on the viewing area which stores the indicative data corresponding to a display screen, and a display screen, A display means to read and display the indicative data stored in said viewing area, The multi-window display unit characterized by making all the indicative datas of all the windows that are equipped with the control means which transmits an indicative data to said viewing area from said non-display field, and said display means is made to display on said non-display field store.

[Claim 2] Said control means is a multi-window display unit according to claim 1 characterized by carrying out the rectangle transfer only of the indicative data of the visible region of the window which performs the lap judging between the windows displayed on said display means, and is obtained by this judgment from said non-display field to said viewing area.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the display unit in which a multi-window display is possible.

[0002]

[Description of the Prior Art] In the multi-window display unit which displays two or more windows on a screen, many things which adopted the overlap mold windowing system which permits that windows overlap as a display gestalt of a window conventionally are used. Moreover, it is saved in memory (primary storage) as a drawing command (for example, drawing commands, such as a line and a circle)

(screen information), and CPU in equipment (central processing unit) read this drawing command from memory, and the alphabetic character, graphic form, etc. displayed in each window on a screen are the things which read and to do for drawing command execution, and was drawing the alphabetic character, the graphic form, etc. in the window.

[0003] Drawing 9 is the configuration block Fig. of the conventional multi-window display unit. When the application 75 read from the magnetic disk drive etc. on the primary storage 72 performs the display demand of a window to a windowing system 74 in a configuration like drawing 9 , The window which displays a windowing system 74 on the screen of a display 78 by this display demand first after this, For example, it controls by lapping between the windows already shown on the screen by the display demand before this display demand from said application, or the display demand from other applications. And it reads from the field where especially the primary storage 72 is not illustrating the drawing command which is the screen information of a window, and by executing this drawing command, an indicative data is generated and this indicative data is written in video memory 76. And it memorizes to the field to which especially the primary storage 72 is not illustrating the drawing command which is the screen information of a window to it and coincidence (preservation). This saved drawing command is used, when the display gestalt of a window changes so that it may mention later. The indicative data written in video memory 76 is displayed on the screen of a display 78 through a display circuit 77.

[0004] If a user operates a mouse 79 etc. and performs migration, elimination, etc. of a window where two or more windows overlapped mutually and are displayed, the lap condition between windows will need to change and it will be necessary to display some or all of a window that was not displayed until now. In this case, it was redrawing by clearing the field once hidden although a screen is updated in the background color of a screen, reading said drawing command memorized by the primary storage 72, generating the indicative data of a window and writing this indicative data in video memory 76 by executing this drawing command.

[0005]

[Problem(s) to be Solved by the Invention] As mentioned above, in the conventional multi-window display unit The lap condition between windows changes with migration, elimination, etc. of a window. When the field hidden until now [of a window] needed to be displayed, after clearing the field hidden once in the background color of a screen, screen restoration was performed by drawing an alphabetic character, a graphic form, etc. again using the drawing command saved on the primary storage. Therefore, when the processing time which the redraw of read-out of a drawing command, generation of the indicative data based on activation of this drawing command, etc. takes started for a long time and the lap condition of a window changed, there was a fault that a flicker arose on a screen.

[0006] The technical problem of this invention is offering the multi-window display

unit which a flicker does not produce by shortening the renewal time amount of a window display.
[0007]
[Means for Solving the Problem] Invention according to claim 1 is equipped with each following means as shown in drawing 1 . The indicative-data storing means 100 is a store which stores the indicative data which can be displayed on a display screen, and has two fields of the non-display field 102 which stores the indicative data which is not further displayed on the viewing area 101 which stores the indicative data corresponding to a display screen, and a display screen.
[0008] The display means 103 reads the indicative data stored in said viewing area 101, and displays it on the display screen. A control means 104 transmits an indicative data to said viewing area 101 from said non-display field 102.
[0009] And it is made to make all the indicative datas of all the windows displayed on a display screen store in said non-display field 102. Moreover, said control means 104 performs the lap judging between the windows displayed on the display screen, and may be made to carry out the rectangle transfer only of the indicative data of the visible region of the window obtained by this judgment to said viewing area 101 from said non-display field 102.
[0010]
[Function] When the lap condition of a window etc. changes and it updates a display screen, a control means 104 transmits the indicative data of the window stored in the non-display field 102 of the indicative-data storing means 100 to the viewing area 101 of the indicative-data storing means 100. In case a display screen is updated, it becomes unnecessary to redraw the indicative data of a window by executing a drawing command, and comes to be able to perform high-speed renewal of a screen by carrying out like this.
[0011] That is, since he is trying to store all the indicative datas of a window in the non-display field 102, on a display screen, the indicative data of the part hidden in other windows, i.e., the indicative data which does not exist in a viewing area 101, exists in the non-display field 102. So, the lap condition of a window etc. changes, even when the indicative data of the part hidden until now is needed, it is not necessary to execute a drawing command and to newly generate this indicative data, an indicative data is only transmitted to a viewing area 101 from the non-display field 102, and renewal of a screen can be performed.
[0012] Moreover, the lap judging between windows is performed, and if a control means 104 is made to carry out the rectangle transfer only of the indicative data of the visible region of the window obtained by this judgment to said viewing area 101 from said non-display field 102, it can lessen the amount of data transfer.
[0013]
[Example] Hereafter, the example of this invention is explained to a detail, making a drawing reference. Drawing 2 is the block diagram showing the system configuration

of the multi-window display unit of this example.
[0014] As shown in drawing 2 , this example consists of CPU (central processing unit)1, a primary storage 2, video memory 6, a display circuit 9, a display 10, and a mouse 11.
[0015] CPU1 controls the whole equipment of this example by performing an operating system (OS) 3, a window library (function), and various applications 5.
[0016] A primary storage 2 is storage which stores the operating system (OS) 3 which CPU1 performs, the window control section 4, and various application 5 grades. The window control section 4 consists of a window library, the window definition Research and Data Processing Department, the window display Management Department, and the window priority Management Department and the window video memory Management Department.
[0017] A window library is a program group which performs processing relevant to window control, such as a window display, and is performed by CPU1. The window definition Research and Data Processing Department performs management of the definition information on a window, or a drawing attribute. As definition information on a window, there are a window identifier number, a parent-window identifier number, window generation size (magnitude of a window body), a window display size (magnitude at the time of actually displaying a window body on the screen of a display 10), a window display position (coordinate on the screen of the display 10 which displays a window), a display starting position in a window, a window background color, etc., for example.
[0018] The window display Management Department manages the information on the rectangle field coordinate of the window currently displayed on the screen of a display 10, and the lap relation of windows. The window priority Management Department manages the vertical relation at the time of displaying a window in piles.
[0019] The window video memory Management Department manages the use address size of the window work-piece buffer gained by the window generate time to the non-display field 8 of video memory 6.
[0020] Video memory 6 is storage with which the indicative data which can be displayed on a display 10 is stored. Video memory 6 is divided into two fields of the screen of a display 10, the corresponding viewing area 7, and the other non-display field 8 in this example. The indicative data written in the viewing area 7 is displayed on the screen of a display 10 by the display circuit 9 mentioned later. On the other hand, the indicative data written in the non-display field 8 is not displayed on display 10 screen. CPU1 can perform R/W of an indicative data similarly to these two fields. In addition, in this example, the non-display field 8 has one 3 times the storage capacity of this to the viewing area 7.
[0021] A display circuit 9 is a control circuit which it is beginning to read [control circuit] suitably the indicative data written in the viewing area 7 of video memory 6, and displays the display image on a display 10. In addition, a display circuit 9 cannot

read the indicative data written in the non-display field 8 of video memory 6.
[0022] A display 10 is an indicating equipment which displays two or more windows etc., for example, consists of a CRT (cathode ray tube) display, a liquid crystal display, etc. A mouse 11 is a pointing device, for example, is used for directing the actuation of migration of a window, deformation, etc. displayed on a display 10.
[0023] next, the processing which the multi-window display unit of this example performs -- explaining . In this example, the following processings are performed as processing about a window. When there is a display demand of a window from application etc., first, as window generation processing, the window control section 4 registers the definition information on a window into the window definition Research and Data Processing Department etc., and gains the window work-piece buffer for storing the indicative data of the whole window to the non-display field 8 of video memory 6. This window work-piece buffer is a field which stores indicative datas of the whole window, such as the windows A and B mentioned later. Next, the alphabetic character, graphic form, etc. displayed in a window as screen information drawing processing to the window work-piece buffer gained to the non-display field 8 of video memory 6 are drawn. And a rectangle transfer is carried out and the viewing area 7 of video memory 6 is made to display the indicative data drawn by the window work-piece buffer on the screen of a display 10 as a window display process based on window definition information etc.
[0024] Moreover, if migration of a window is directed by actuation of a user's mouse 11 to the window displayed by doing in this way, the window control section 4 will change the display position of this window on the screen of a display 10, and will update a screen by window display processing mentioned later after that. Moreover, a screen is updated by window display processing which will change the magnitude as which the window is displayed according to directions, and will be later mentioned after that by actuation of a mouse 11 etc. similarly if deformation of a window is directed.
[0025] Furthermore, when deleting a window by termination of application etc., the window control section 4 eliminates this window currently displayed on the screen of a display 10, performs deletion of the definition information on this window, and release of a window work-piece buffer, and updates a screen by window display processing mentioned later after that.
[0026] Next, the detail of actuation of the multi-window display unit of this example is explained by making a display and elimination of a window into an example. First, actuation of this example at the time of a window display is explained. It means a window display here carrying out the rectangle transfer of the window body drawn by the non-display field on the screen which is a viewing area, and changing into a visible condition.
[0027] As for drawing 3 , Windows A, B, and C are generated, among those Windows A and B show the condition of the video memory 3 at the time of being display ending in

simulation on the screen of a display 10. Therefore, by the initial state, Window C is not displayed on the screen of a display 10, although generation of a window is carried out. At this time, according to the lap condition of the present window, each window is divided into the visible rectangles A11, B11, and B12 and the invisible rectangle B13, as shown in drawing 3 . In addition, the display priority at this time is the order of A>B>C.

[0028] From the condition which shows in drawing 3 , when displaying Window C on a window on a screen, it laps with order with a low display priority between two windows first, and a condition is judged. And this judgment is performed about the combination of all the visible rectangles of the window displayed on a screen. The detail of the rectangle division approach performed to below in the case of this judgment is explained referring to drawing 4 .

[0029] (a) Judge by lapping between Window C and Window B first. Consequently, drawing 4 (a) Window C is divided into the invisible rectangle C11 and the visible rectangle C12 so that it may be shown. As for Window B, all fields serve as the visible rectangle B11 as it is.

[0030] (b) Next, lap between the visible rectangle C12 of Window C, and Window A, and perform a condition judging. Consequently, drawing 4 (b) The visible rectangle C12 is further divided into the invisible rectangle C122 and the visible rectangles C121 and C123 so that it may be shown. As for Window A, all fields serve as the visible rectangle A11 as it is.

[0031] (c) Finally, lap between Window B (visible rectangle B11) and Window A (visible rectangle A11), and perform a condition judging. Consequently, drawing 4 (c) The visible rectangle B11 is divided into the invisible rectangle B113 and the visible rectangles B111 and B112 so that it may be shown. The visible rectangle A11 is in a condition as it is.

[0032] Above (a) – (c) If the rectangle transfer of the visible rectangles C121 and C123 of Window C obtained as a result of processing is carried out at a viewing area, it will be in the condition which shows in drawing 5 . In addition, since the display condition of Windows A and B does not change in this case, it is changeless to the indicative data of the windows A and B stored in the viewing area 7 of video memory 6. Thus, display processing of Window C is performed.

[0033] Next, actuation of this example at the time of elimination of a window is explained. Elimination of a window changes into an invisible condition the window currently displayed on the screen. In the condition which shows in drawing 5 , when eliminating Window B, Window B is first eliminated by clearing the visible region of Window B in the background color of a screen, next it laps from Window B between the invisible rectangle of the window where a display priority is low, and other windows, and a condition judging is performed. And the field which Window B had hidden judges whether it is again hidden by other windows, and computes the field which should be displayed. The regeneration field calculation approach is explained

below, referring to drawing 6 .
[0034] First, it laps between the invisible rectangles C11 of Window C and Windows A (visible rectangle A11) which were hidden in Window B, and a condition judging is performed. Consequently, as shown in drawing 6 (a), the invisible rectangle C11 is divided into a rectangle C111 and a rectangle C112. A rectangle C111 turns into a visible rectangle, and C112 turns into an invisible rectangle again.
[0035] Thus, the display screen will be updated if the rectangle transfer of the regeneration field C111 of the obtained window C is carried out from a non-display field. Furthermore, each window after renewal of a screen is divided into a visible rectangle and an invisible rectangle like the case of the window display mentioned above. Therefore, the lap condition judging between the window C after window B elimination and Window A is performed. Consequently, drawing 6 (b) Window C is divided into the invisible rectangle C12 and the visible rectangles C11 and C13 so that it may be shown. As for Window A, all fields serve as the invisible rectangle A11 as it is.
[0036] The display screen will be updated, if the visible region of Window B is cleared in the background color of a screen and the rectangle transfer of the regeneration field C111 of Window C is carried out to a viewing area, as mentioned above from the non-display field. Furthermore, if the lap condition between the viewing windows after window B elimination is judged and rectangle division is performed, it will be in the condition which shows in drawing 7 . Thus, elimination processing of Window B is performed.
[0037] Drawing 8 is a flow chart explaining actuation of the window display (updating) processing which gave [above-mentioned] explanation. In addition, S1, S2, and .... show the number of procedure (step) during explanation of the flow chart shown below.
[0038] If the window display demand accompanying the window display demand from application, migration, deletion of a window, etc. is received, it will judge whether CPU1 chose two windows from the window where a display priority is low one by one first, and they have lapped (S1, S2). When the window has lapped as a result of this judgment (S2, YES), the lap judging between the existing visible rectangles of this window is performed (S3). When there is a lap between the existing visible rectangles as a result of this judgment (S3, YES), visible rectangle division processing which was mentioned above is performed (S4). Moreover, when there is no lap between the existing visible rectangles as a result of this judgment (S3, NO), this visible rectangle division processing is not performed, but it progresses to the next processing.
[0039] And it judges whether processing was completed to all the existing visible rectangles of the window under current processing (S5). If there are some which have not been processed yet with the existing visible rectangle as a result of this judgment (S5, NO), the above-mentioned step S3 - S4 will be repeated. Moreover, if processing is completed to all the existing visible rectangles as a result of this judgment (S5,

YES), it will judge whether processing was further completed to a total combination of the window which should be displayed on a screen (S6). In addition, also when it judges with the selected window having not lapped at the above-mentioned step S2 (S2, NO), it progresses to processing of step S6.

[0040] If there is combination which has not been processed yet in the combination of the window which should be displayed as a result of this judgment (S6, NO), the above-mentioned steps S1-S5 will be repeated. Moreover, if processing is completed to a total combination of the window which should be displayed on a screen as a result of this judgment (S6, YES), a rectangle transfer will be performed for the visible region of the window to display called for by the above-mentioned processing to a viewing area from a non-display field (S7).

[0041] In addition, in the above-mentioned example, when the number of windows increases and the non-display field 8 of video memory 6 becomes insufficient, reconstruction processing of the non-display field 8 of video memory 6 is performed at the time of the above-mentioned window generation processing. Reconstruction processing is processing which summarizes the free area of the non-display field 8 which is discontinuous, and makes it one free area by repeating generation and elimination of a window.

[0042] Furthermore, since a window cannot be newly created unless other windows are deleted when video memory 6 is insufficient even if it performs reconstruction processing of the non-display field 8 of video memory 6, the message which notifies a user of that is displayed on the screen of a display 10.

[0043]

[Effect of the Invention] As mentioned above, since not a redraw method but the regeneration method by rectangle transfer (block transfer processing between video memory) performs a display or screen-display update process of a window according to this invention as explained to the detail, the drawing processing times, such as an alphabetic character and a graphic form, can be excluded, compaction of the renewal time amount of a display is achieved, and a high-speed display is attained. For this reason, when the lap condition of a window changes, it becomes, without a flicker arising.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the principle Fig. of this invention.

[Drawing 2] It is the system configuration Fig. of the example of this invention.

[Drawing 3] It is drawing showing the condition of the video memory of an example.

[Drawing 4] It is drawing explaining rectangle division processing of a window.
[Drawing 5] It is drawing showing the condition of the video memory of an example.
[Drawing 6] It is drawing explaining rectangle division processing of a window.
[Drawing 7] It is drawing showing the condition of the video memory of an example.
[Drawing 8] It is a flow chart explaining actuation of a window display process.
[Drawing 9] It is the configuration block Fig. of the conventional multi-window display unit.
[Description of Notations]
1 CPU
2 Primary Storage
3 OS
4 Window Control Section
5 Application
6 Video Memory
7 Viewing Area
8 Non-display Field
9 Display Circuit
10 Display
11 Mouse